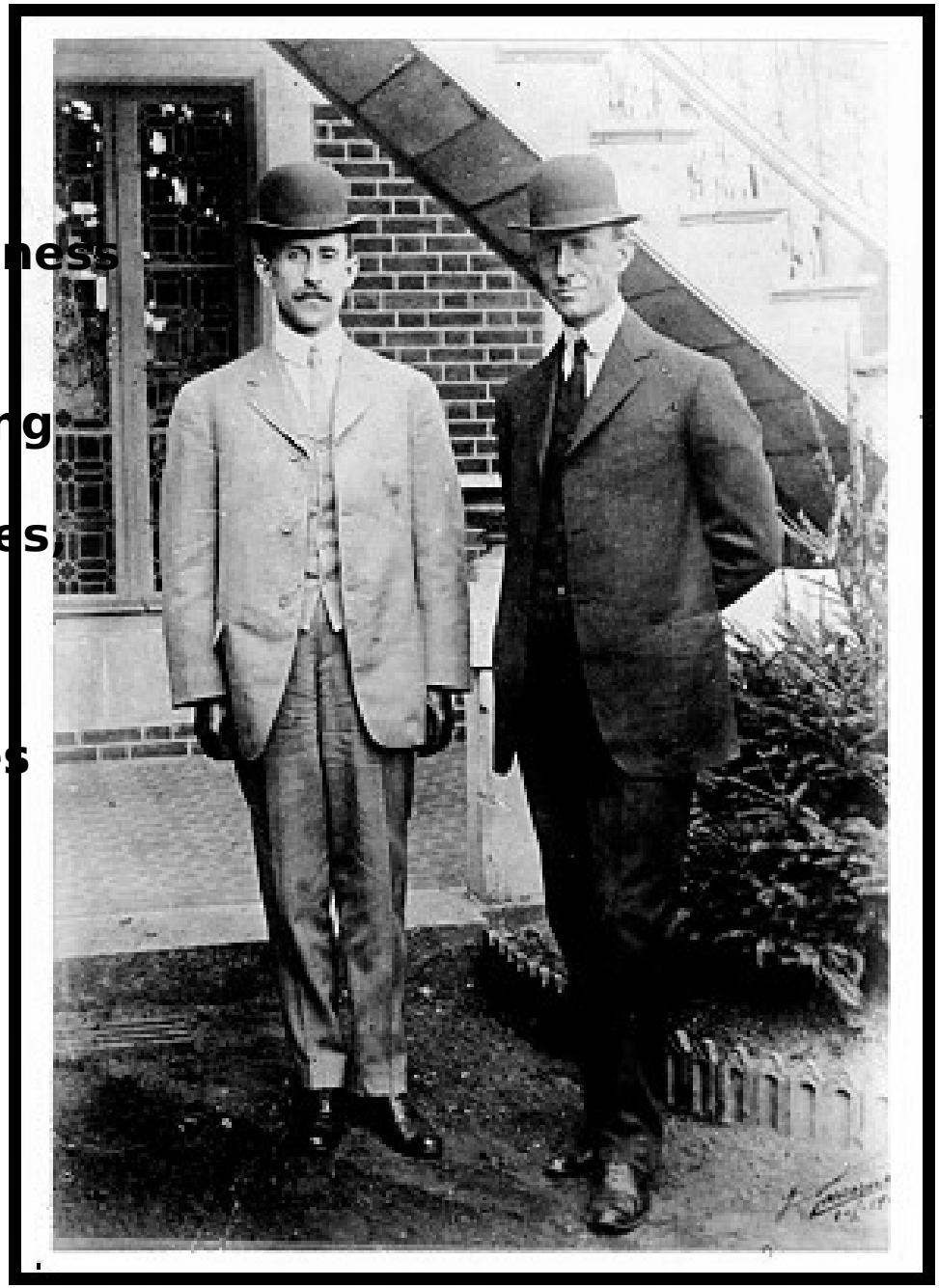
Human Factors Considerations of the Early Wright Brothers' Aircraft

Joe McDaniel
Wright Brothers Historian

Wright Brothers

- 1889-1892 newspaper business
- 1892 bicycle rapair/sales business + Job printing
- 1896 manufactured bicycles, rapair/sales
- 1899-1912 researched, developed, & sold airplanes



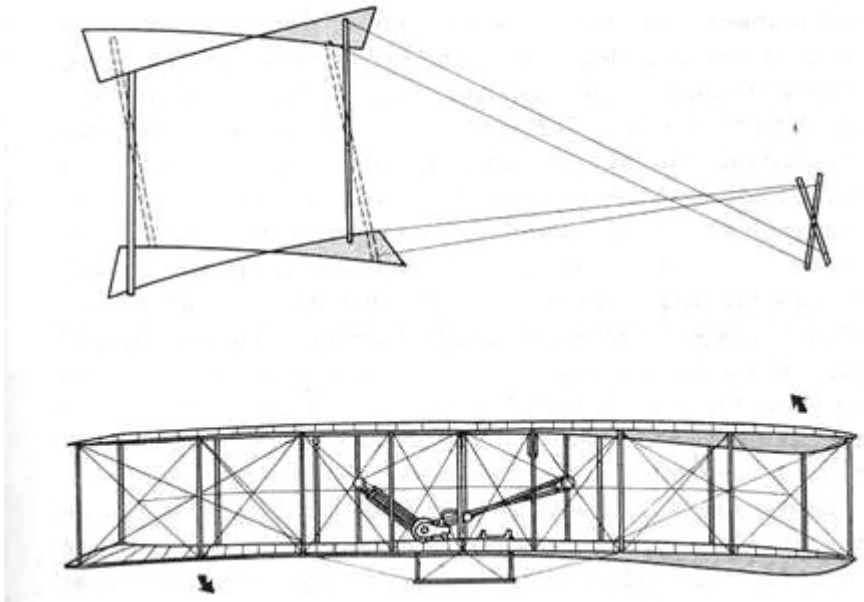
The Wrights before 1899

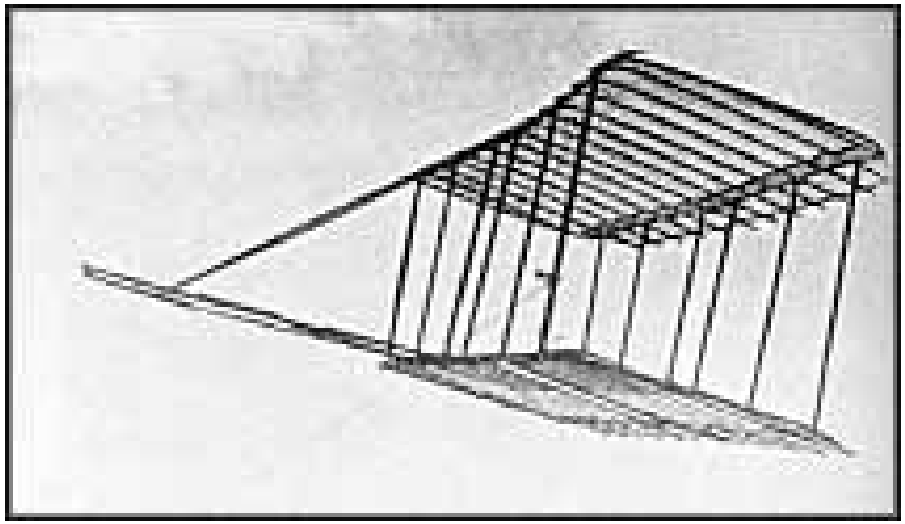
1127 W. 3rd, Dayton, Ohio

7 Hawthorne Street, Dayton, Ohio

Wright
Van Cleve

Wrights' Aug 1899 Kite
to test concept of Wing Warping



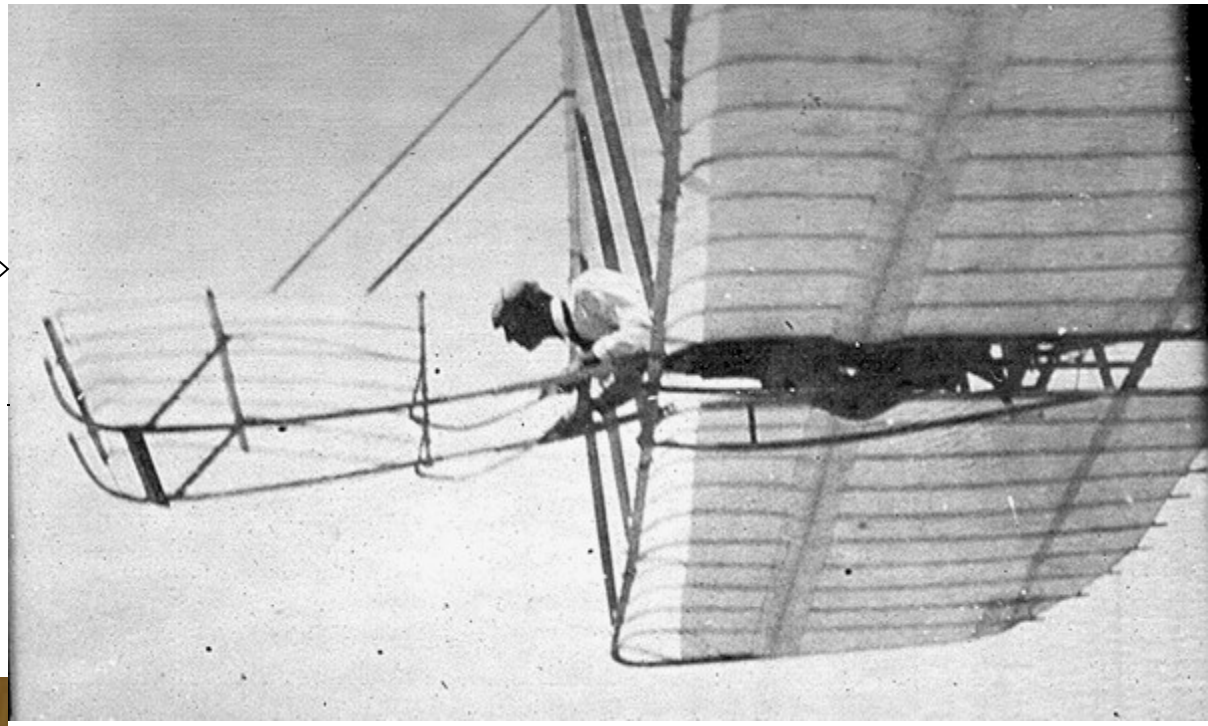


1900 Wright Glider
17.5 ft. wingspan
52 pounds

No tail, no yaw control

Wrights' 1901 Glider

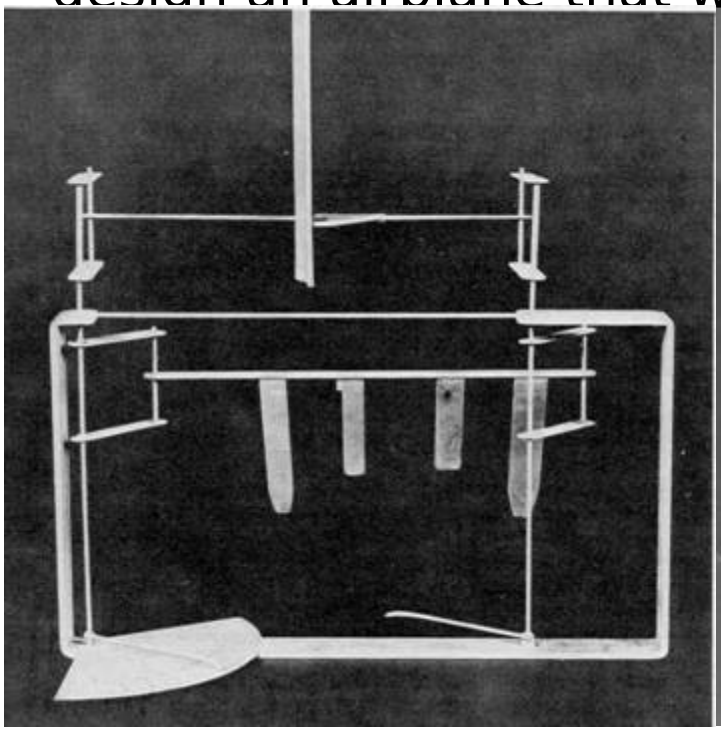
1901 Wright Glider
22 ft. wingspan
98 pounds
3:1 aspect ratio

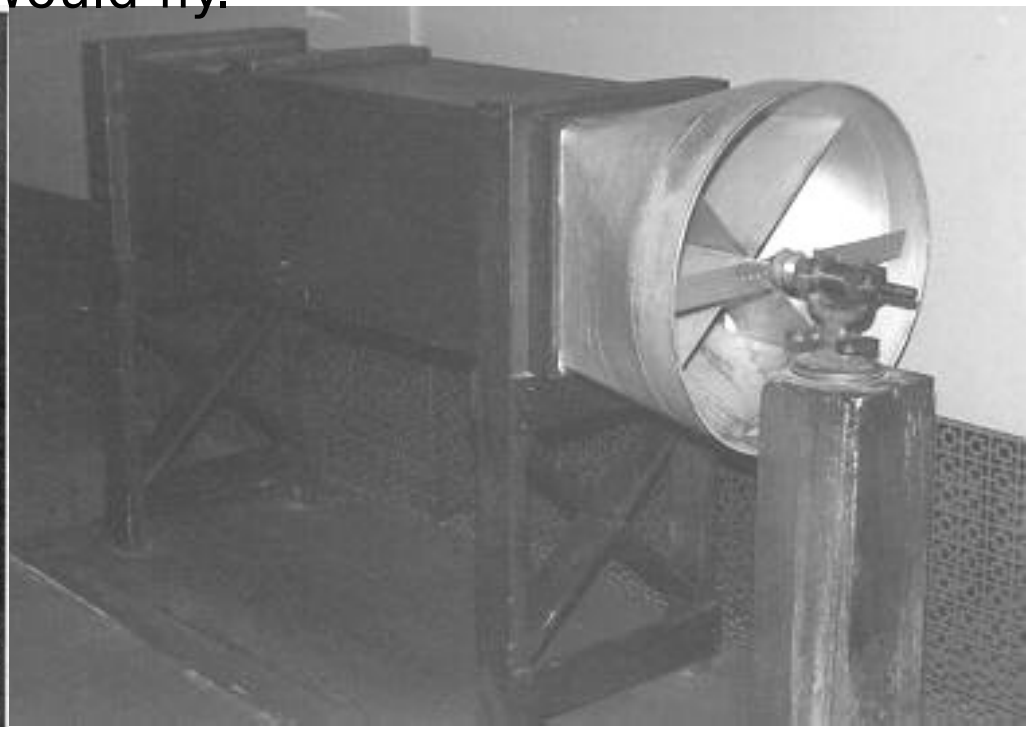


No tail, no yaw control
Foot control for wing warping (roll)

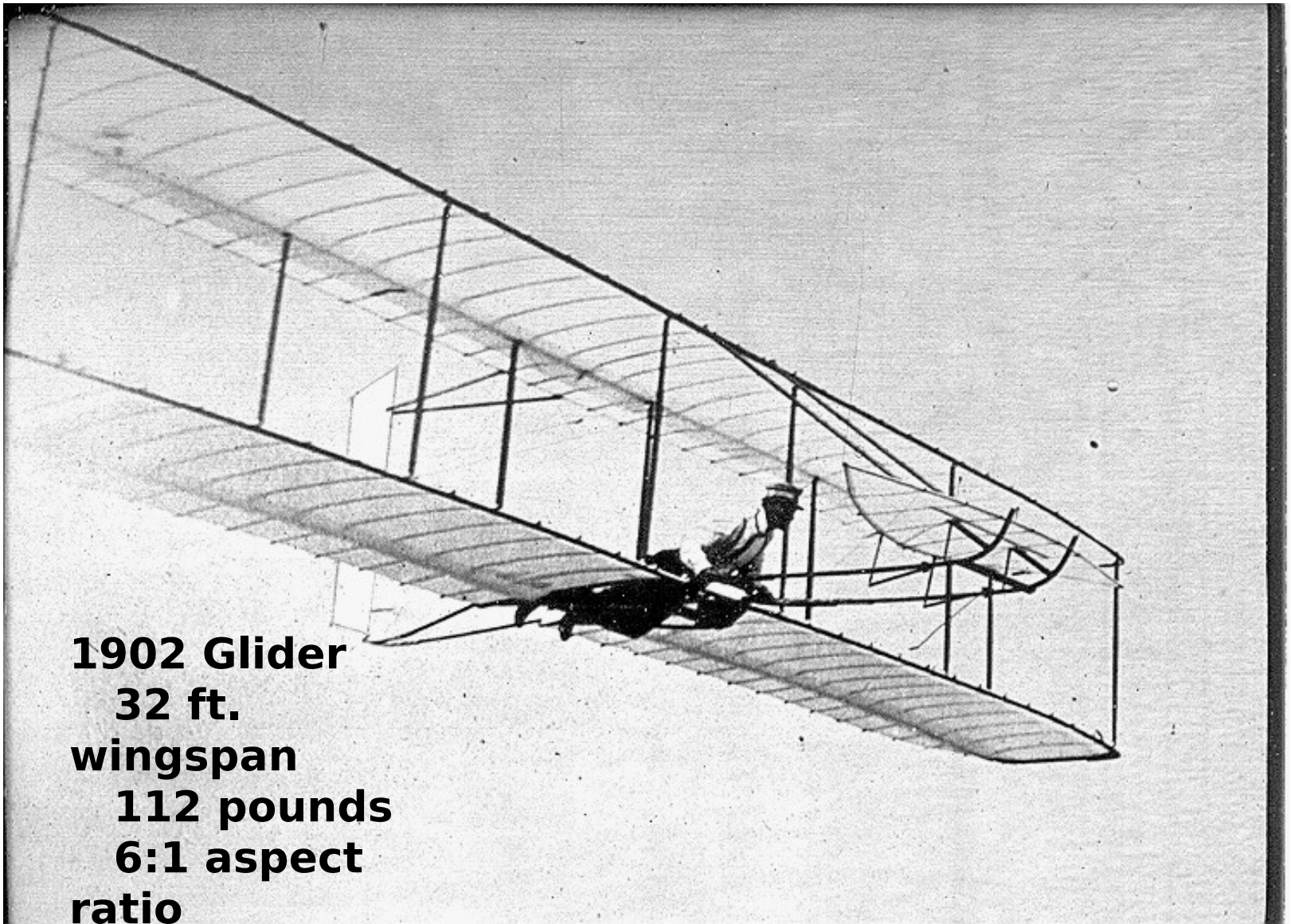
Wright Brothers develop the science of aerodynamics

Wind Tunnel - During Oct-Dec 1901. Wrights conduct further tests of airfoils with wind tunnel and pressure-testing balances of their own design, becoming the first investigators to compile tables of figures from which it was possible to design an airplane that would fly.





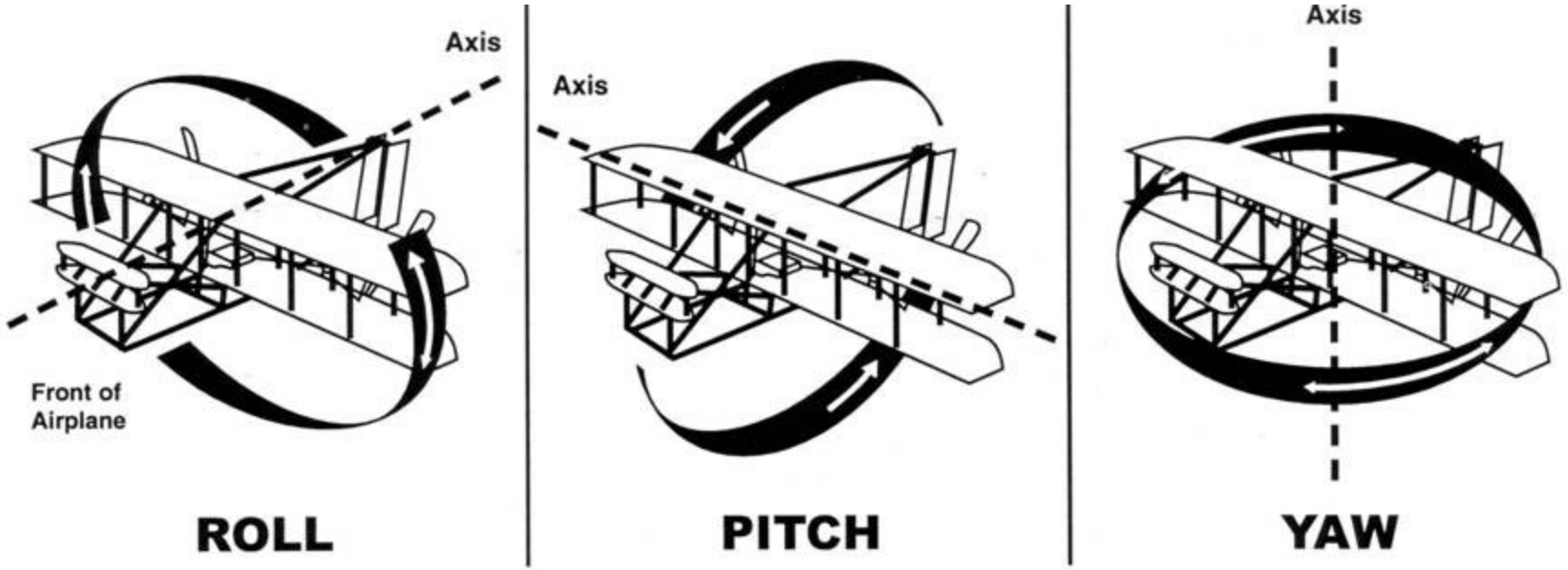
First aircraft with 3-axis control



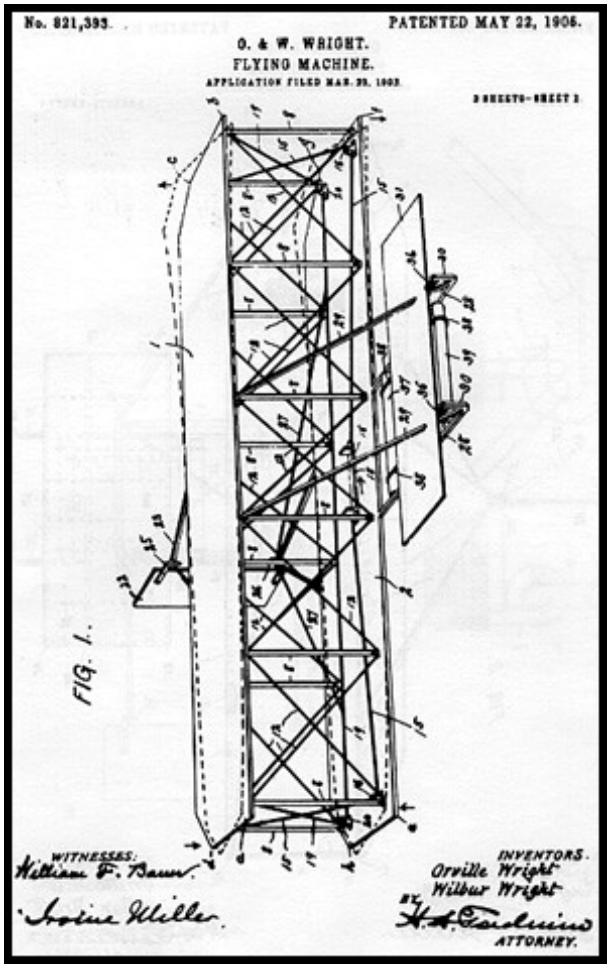
1902 Glider
32 ft. wingspan
112 pounds
6:1 aspect ratio

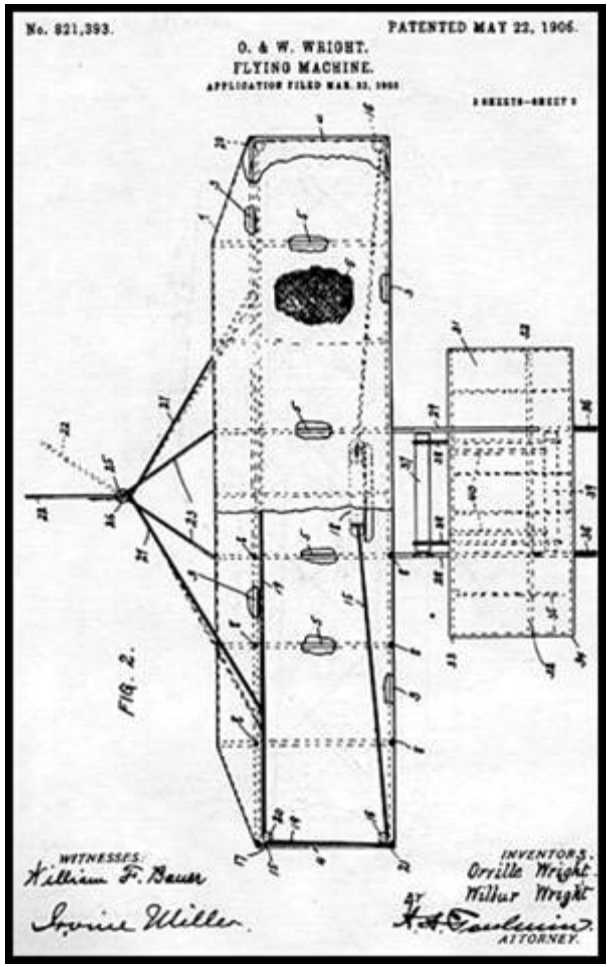
1902 Glider Controls

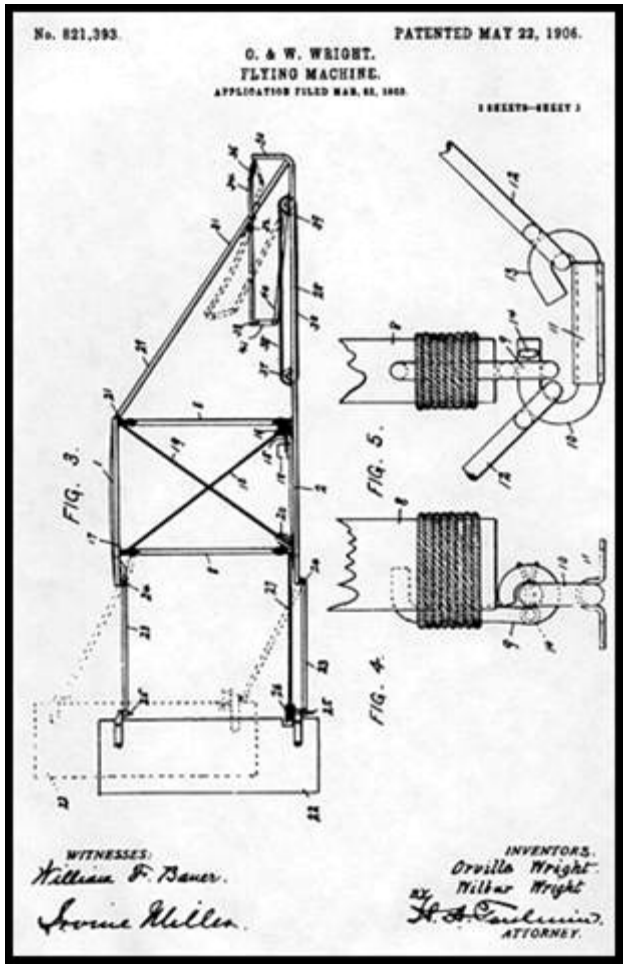
3-Axis Control



Pioneer Airplane Patent is 1902 Glider

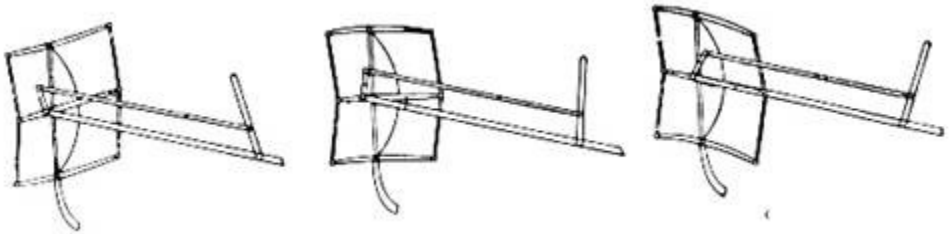




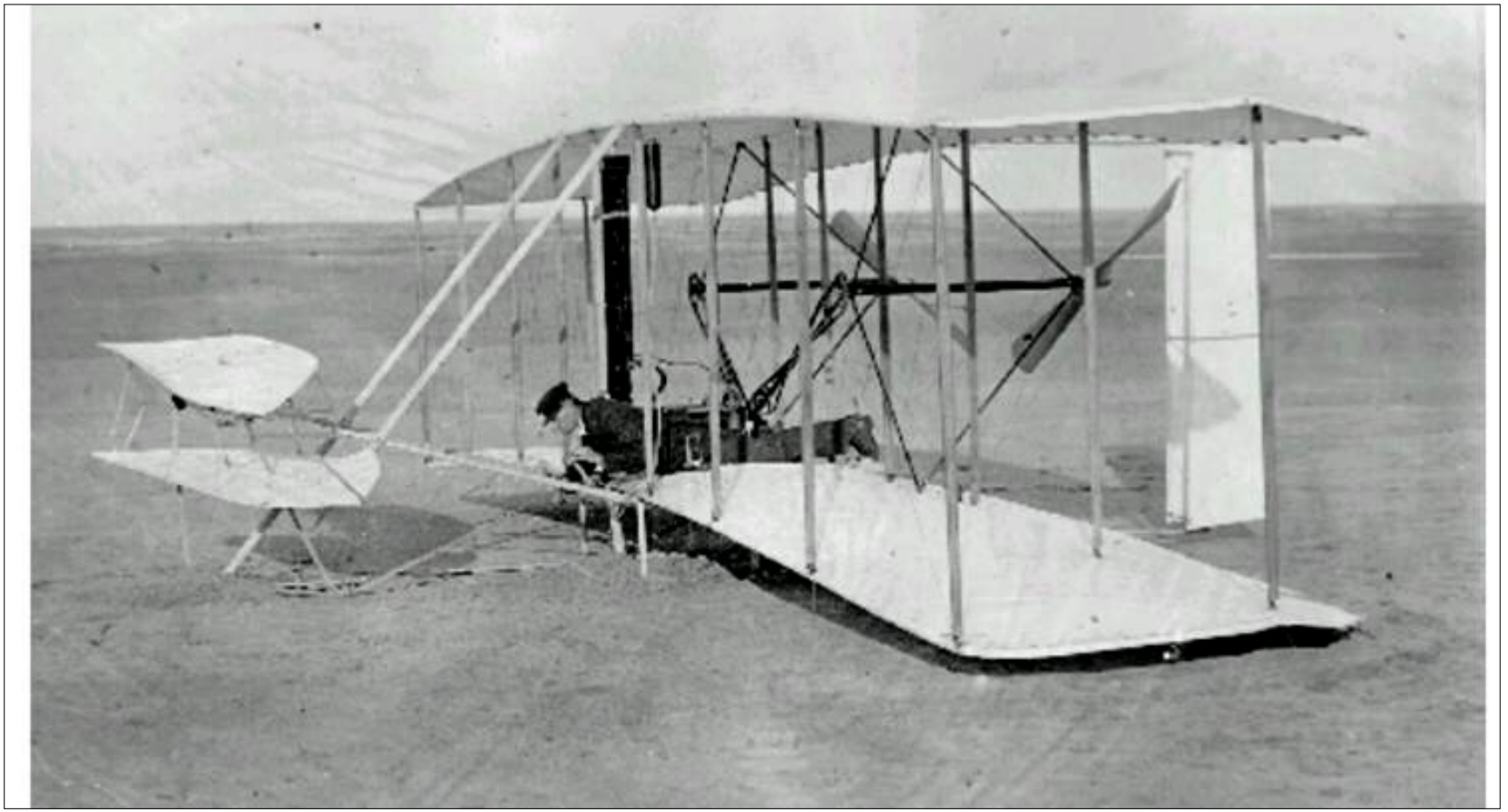


Replica 1903 Flyer on the takeoff rail

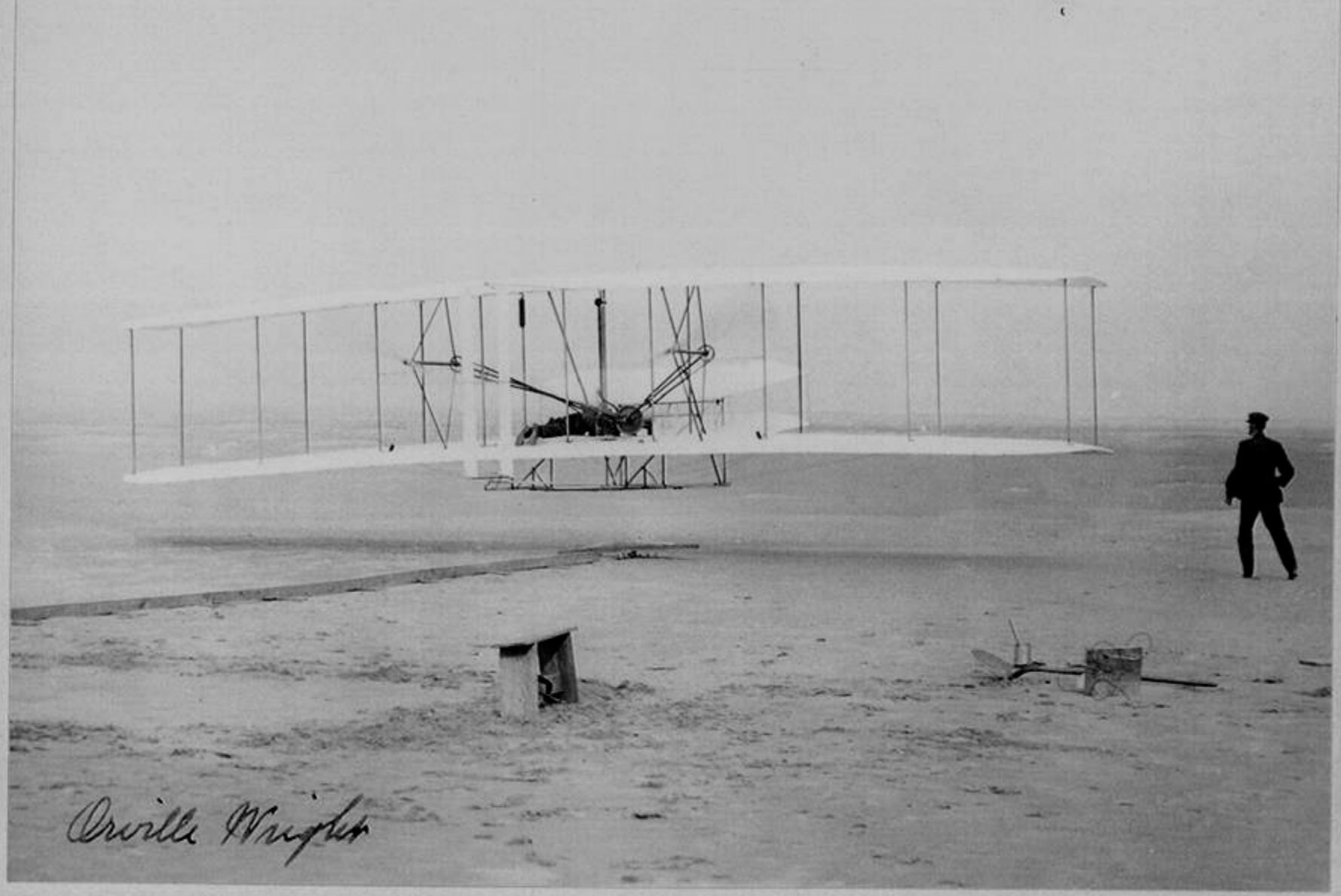
Replica Wright 1903 Flyer



Wrights' First Try - 14 Dec 1903



Having trouble controlling pitch, Wilbur stalled and damaged plane
Distance = 115 feet in 3.5 seconds; Not a successful flight
Minor damage repaired in 2 days



DECEMBER 17, 1903

FIRST AEROPLANE FLIGHT

KITTY HAWK, N. C.

Success four flights thursday ...

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176 C KA CH 55 Paid. Via Norfolk Va

Kitty Hawk N C Dec 17

Bishop M Wright

7 Hawthorne St

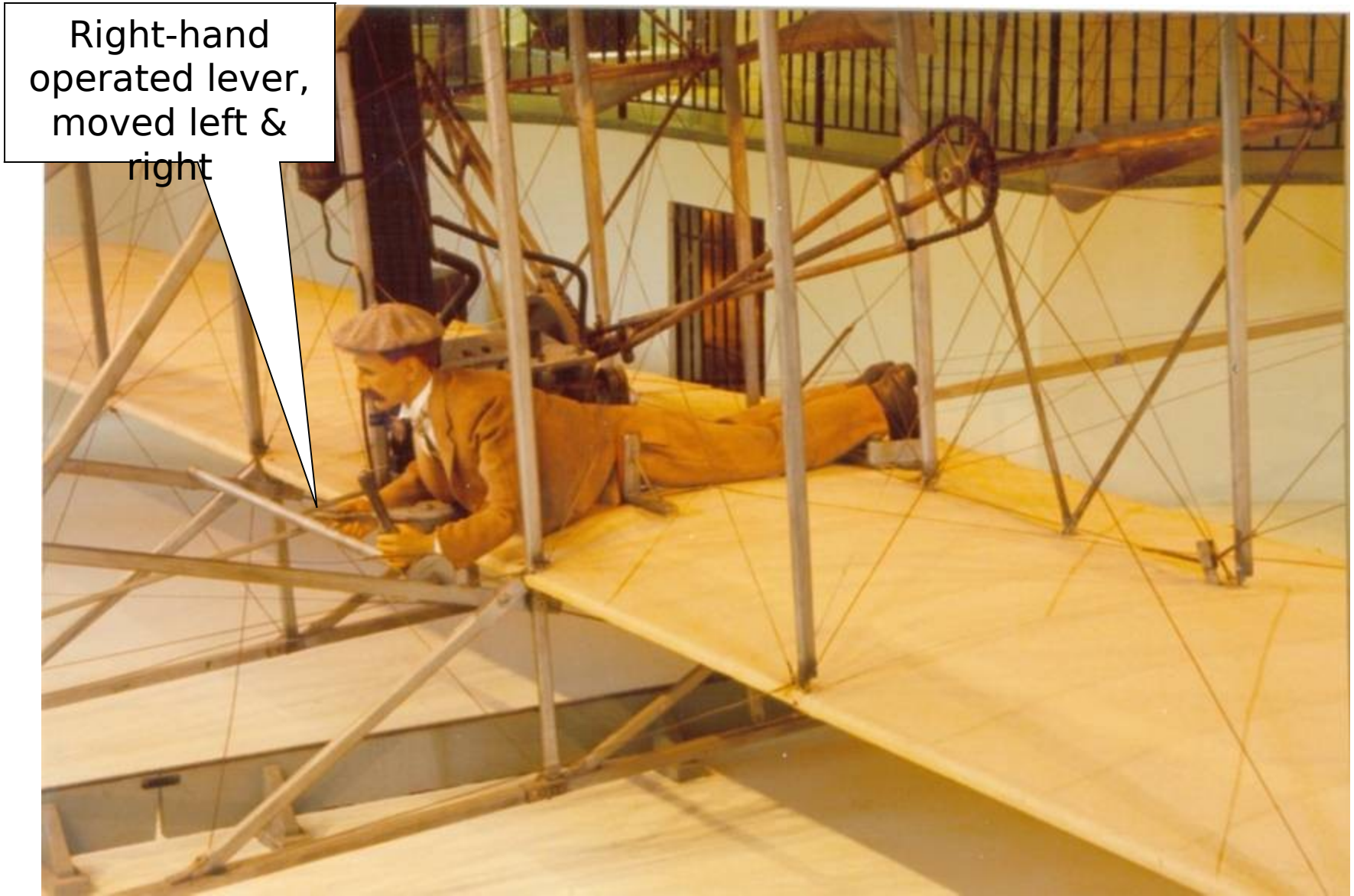
Success four flights thursday morning all against twenty one mile wind started from Level with engine power alone average speed through air thirty one miles longest 57 seconds inform Press home ~~Xmas~~ Christmas .

Orevalle Wright 5.25P

1903 Wright Flyer at Smithsonian's NASM

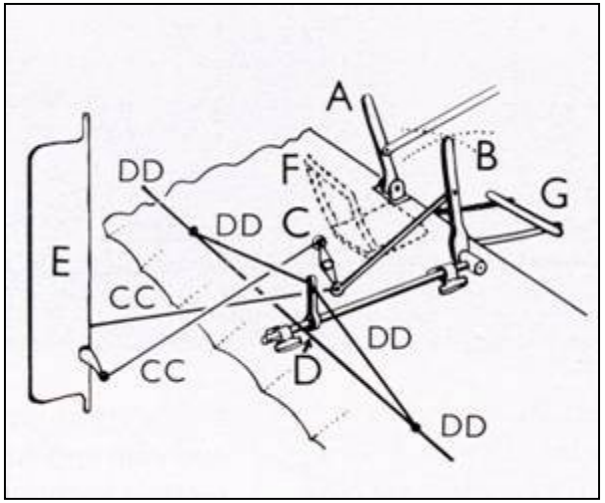
1905 Wright Flyer

1905 - First with Separate Rudder Control



Side-by-side wing warp & rudder controls on 1908 Signal Corps Flyer

Wilbur-type single stick & wing warp and rudder controls
used on all French, Italian, UK models 1909 - 1913



Wilbur-type

100 Years of AIRPOWER

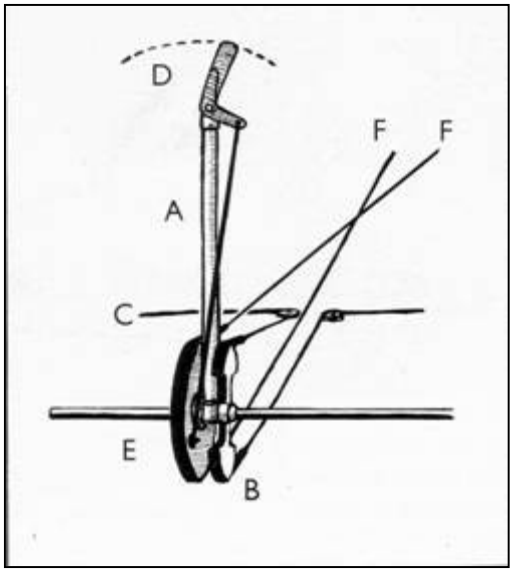
1st Display
Angle of Attack
Slip

2nd Display
Angle of Attack

The Early Years

Wilbur (left) and Orville Wright build the first heavier-than-air military flying machine - 1909

Orville-type wing warp/rudder controls used on all US/German models A – G during 1909 - 1913

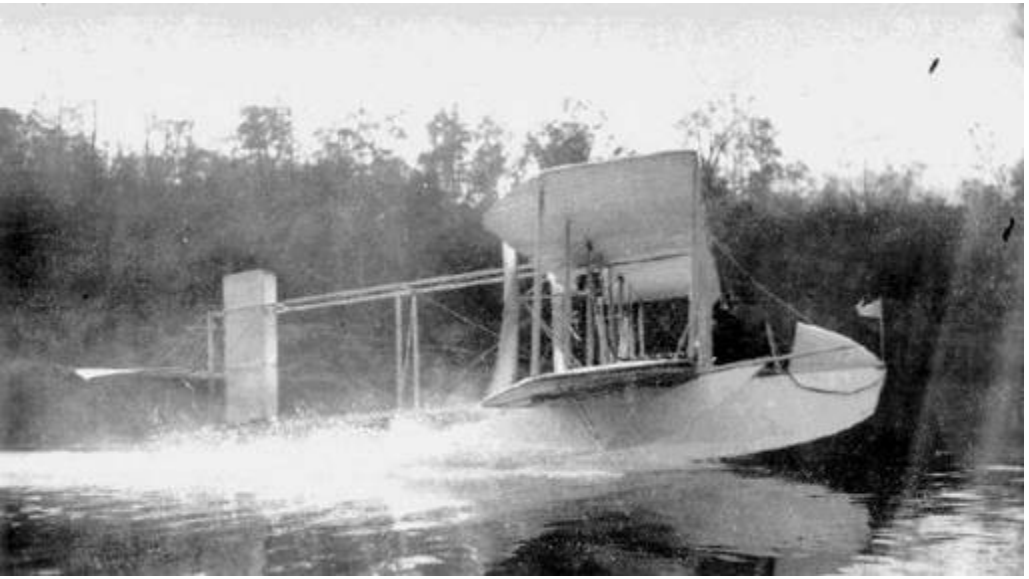


Orville-type control

1st Motion-base Simulator

Left and Right Handed Pilots
Pilots shared center-mounted wing warp/rudder control

Wright 1913 Model G Flying Boat
Optional Wheel Control



"Navy Tries Standard Control"

Aeronautics (New York), Vol 13, No 2, Aug 1913, p 56.

The U.S. Navy will be the first military, or civil body in the world to adopt a standard method of control. The necessity for this has previously been announced in this magazine.

A temporary conclusion has been arrived at by theoretical analysis, and **Captain Washington Irving Chambers** intends to put this in each of a Wright and Curtiss machine in one seat but hooked up to the old control so that either aviator can work it.

This will be tested, as well as all other systems and modifications on a land machine that is being rigged up, whereby each aviator can be tried with each system and the **fatigue, smoothness and all other results can be recorded chronographically and compared**. The final result will be fitted in all machines on one side of the double system and when all aviators are proficient the old controls will be replaced entirely. **The aviators themselves are at last stirred up to desiring the change, but, of course, are not unanimous as to recommendations.**

NASA Dryden Flight Research Center Photo Collection
http://www.dfrc.nasa.gov/gallery/photo/index.html
NASA Photo: EC02-0264-3 Date: November 15, 2002 Photo by: Carla Thomas
The modified F/A-18 being flown in the joint NASA/Air Force Active Aeroelastic Wing research program shows off its colors during its first checkout flight from NASA's Dryden Flight Research Center.

Back to the Future

Active Aeroelastic Wing

Uses “Wing Warpring”